Pb_5 Cl $(AsO_4)_3$ + Pb_5 Cl $(VO_4)_3$ or about equal proportions of vanadinite and mimetite. He has assigned to them the name Endlichite in honor of Dr. F. M. Endlich, superintendent of the Sierra mines at Lake valley, N. M. The same paper contains new analyses of vanadinite and a crystallographic investigation, by Professor G. vom Rath, of the New Mexican decloizite, illustrated by four figures. These crystals, which are the best ones thus far known, indicate that the mineral is orthorhombic, as was surmised by Des Cloizeaux instead of monoclinic as held by Websky. Associated with the vanadinite of Sierra Grande fine crystals of iodyrite were also found.

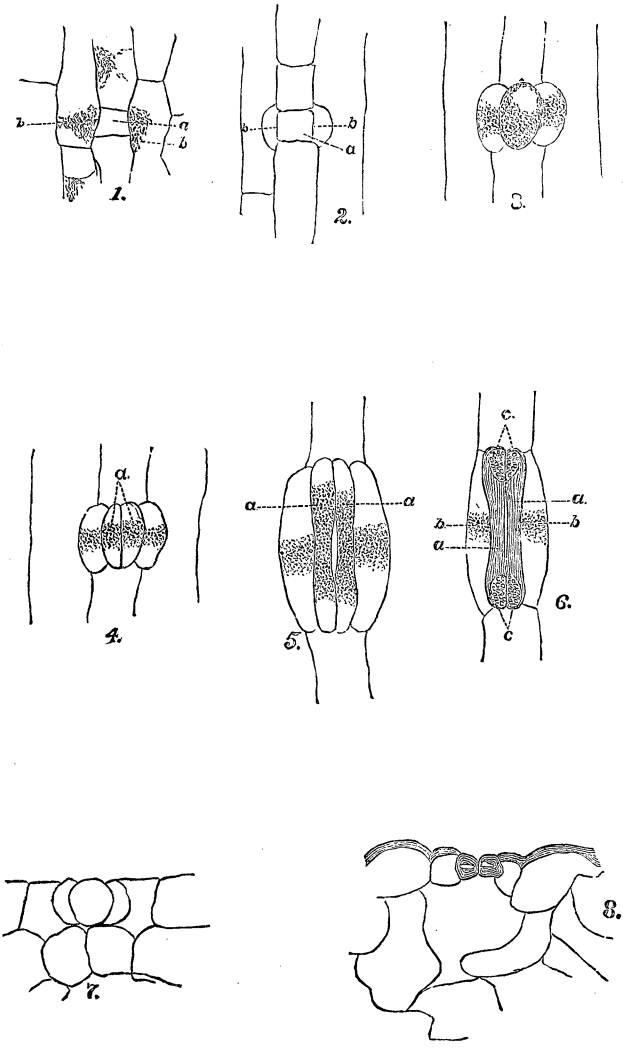
BOTANY.[1]

AMERICAN MEDICINAL PLANTS.—We recently noticed the first fascicle of this work, by Dr. Millspaugh, as worthy of patronage. An examination of the second fascicle confirms our favorable opinion. The illustrations are very good, and will not only serve admirably their purpose of enabling the medical student to recognize the various species of medicinal plants, but they will be found of value to the teacher or student of ordinary botany. In the second fascicle there are colored plates of *Actæa spicata*, *Carya alba*, *Cephalanthus occidentalis*, *Cypripedium pubescens*, *Equisetum hyemale*, *Juglans cinerea*, *Mitchella repens*, *Thuja occidentalis*, *Viola tricolor*, etc., etc., thirty in all.

DEVELOPMENT OF STOMATA OF THE OAT.—Before the stomata appear the epidermis is composed of quadrangular cells, which afterwards grow much faster in length than in breadth. The mother-cell of a stoma is cut off from the end of one of these cells, and sometimes each cell in a row furnishes a stoma (Fig. 1 *a*). This mother-cell rapidly increases in size, and large masses of protoplasm touching the cell soon become evident in the cells adjacent to the sides (Fig. 1 *b b*). This gathering of protoplasm is preparatory to the formation of accessory cells, which are at first nearly semicircular, and are cut out of the adjacent cells, one on each side of the mother-cell (Fig. 2 *b b*). The central and accessory cells now enlarge in about the same proportion until the former divides into two guard cells (Fig. 4); after this the accessory cells encroach upon the guard cells until in the mature stoma the latter are narrower through the center than at the ends; and the width of the whole four cells is but little more than of one single epidermal cell (Fig. 6).

The behavior of the protoplasm is very characteristic, the general rule is as follows: The mother-cell and the accessory cells are both at first full of rich protoplasm. In the accessory cells this tends to condense in the center; vacuoles first appear in the ends of the cells (Fig. 3), these increase in size with the develop-

[1] Edited by PROFESSOR CHARLES E. BESSEY, Lincoln, Nebraska.



Stomata of the Oat.

ment of the stoma (Fig. 4), and in the mature stoma the visible protoplasm consists merely in a large nucleus in the center of each cell (Fig. 6 *b b*). In the mother-cell one or two vacuoles may appear in any place, one central vacuole is perhaps the most frequent form (Fig. 3), but when division takes place a band of thick protoplasm stretches across the center of the cell (Fig. 4 *a*). Instead of condensing this tends to extend through the length of the cells leaving vacuoles only in the extreme ends (Fig. 5 *a a*). In the immature stoma this protoplasm is very slightly granular and has a slight green tinge, as if chlorophyll is being formed (Fig. 5); but in the mature stoma it appears perfectly homogeneous, and small chlorophyll bodies which show the presence of starch on application of iodine, occupy the former vacuoles. A cross-section, made before the mother-cell has divided, shows very thin walls (Fig. 7), but a section of a mature stoma represents the guard cells as having thick walls, and I think it probable that most of the protoplasm has been absorbed in the thickening process (Fig. 8). This behavior of the protoplasm varies some in different stomata, especially in the stages represented in Figs. 3 and 4, but the process described prevails, and seems to be typical.

The methods of finding the different stages of development are very simple. If the leaves of a growing plant be unrolled until the youngest is reached and the base of this used, it will show the youngest forms. It is useless to attempt to remove the epidermis, for the leaves which would contain the undeveloped stomata are too tender to permit it. Soaking the young leaves in a two per cent salt solution for about ten minutes aids in showing the formation of the accessory cells, if an examination is made immediately.—*Effie A. Southworth, Bot. Lab. Univ. Mich.*

EXPLANATION OF PLATE XXIII.

× 425.

FIG. 1.—Mother-cell of stoma.
" 2.—Mother-cell and accessory cell.
" 3.—Same more advanced.
" 4.—Same with mother-cell divided into two guard cells.
" 5.—More developed stage of same.
" 6.—Mature stoma.
" 7.—Cross-section of a young stoma.
" 8.—Cross-section of a mature stoma.

THE OPENING OF THE FLOWERS OF DESMODIUM SESSILIFOLIUM.—This Desmodium, which grows abundantly in Central Iowa, presents a structural and physiological adaptation for securing pollination which is quite interesting. The purplish flowers are about 1.5 centimeters long and are arranged in pairs, racemosely upon a spreading terminal inflorescence. The keel is at first enclosed within the wings, which in turn enclose the stamens and

pistil. The standard projects forward approximately parallel with the other petals, diverging from them at a small angle (Fig. 1). The standard now begins to bend upwards and the wings and keel downwards, the resistance offered by the sepals being such as to cause the wings and keel with their contained stamens and pistil to be strongly deflexed (Fig. 2). The flower is now in a state of tension, and may be likened to a spring trap ready set for action.

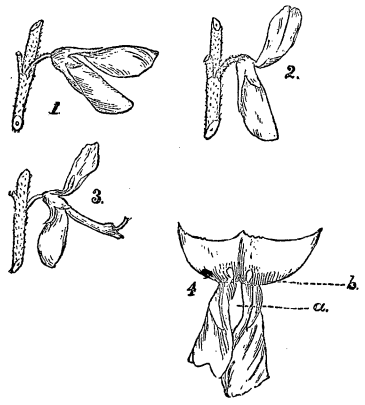


FIG. 1.—Flower when first opened; and before the petals begin to reflex. FIG. 2.—The same with the petals reflexed; the flower in a state of tension. FIG. 3.—The same after the stamens have sprung out from the wings and keel. Fig. 4.—Front view of the base of the standard (cut away above) and the bases of the wings, showing at *a* the opening to the honey reservoir, and at *b* the eye-spots. 1, 2 and 3 natural size, 4, enlarged.

A little examination will show that many of the flowers have changed the relation of their parts, the tension being in a great measure relieved (Fig. 3). A closer inspection shows that when the flower is in a state of tension, the stamens and pistil are forcibly drawn downward, as one might draw down the end of a stiff spring. Now in the later flowers mentioned above (Fig. 3), the stamens and pistil have escaped from the deflexed keel and occupy their normal position in the axis of the flower.

If we now take a flower in its state of tension and look down between the separated standard and wings, we notice upon the dark-colored base of the standard two bright yellowish-white eye-like spots which show with remarkable distinctness upon the dark background (*b* Fig. 4). Directly in front of these there is an opening left between the approximated edges of the wings (*a* Fig. 4); this opening appears to be the entrance to the store of honey. Suspecting this and also that the eye-spots had some function, I began feeling the surface of the standard and the wings and the interior stamen tube, in the vicinity of the eye-spots, using a pencil point, with the result that whenever the standard was gently pushed backwards by a touch near the eye-spots, the stamens and pistil would be freed with a violent jerk. The experiment was repeated again and again, invariably with the same result. I was not fortunate enough to observe insects "springing" these traps, but from the fact that nearly every flower upon an exposed plant eventually is thus opened, there can be no doubt that insects do spring them open. This is rendered still more certain by the

fact that flowers brought into my laboratory where they were not visited by insects, although they were kept in water, did not spring open. Repeated trials under different conditions showed that at the instant the sensitive surface was touched, the basal third of the wings and keel became strongly curved, and that this brought so great a tension upon the stamen-tube and pistil that the latter could not be held longer by the petals, as a bow when bent too far snaps its string and frees itself.

The purpose of this ingenious mechanism is obvious. When the stamens spring out with such violence they throw the pollen forcibly against the body of any insect hovering over the flower or resting upon its wings and keel.—*Charles E. Bessey.*

Botanical News. — The March and April numbers of the *Western Druggist* contain an interesting paper on plant hairs by Professor E. S. Bastin of Chicago. It is illustrated by numerous wood-cuts.——In a recent number of the *Gardeners' Chronicle* Mr. W. G. Smith furnishes an illustration of *Peronospora effusa*. It is in his well-known style, a style against which we are moved to protest vigorously. Conventionalized plant figures may be permissible in art, but certainly they are not in botany.——Recent numbers of *Flora* (Regensberg) contain a paper on the lichens of the French Jura mountains, by Dr. F. Arnold.——The most interesting paper in the May *Journal of Botany* is one by Mr. Spencer Moore upon the Identity of *Bacterium fœtidum* of Thin, with soil Cocci, in which it is shown that the bacteria which produce or accompany "the sweating of the feet" are identical with those producing chemical action in the soil. In the latter situation they reduce the sulphates to sulphites, and the phosphates to phosphites, and in both situations are instrumental in setting free ammonia.——Dr. Vasey's Descriptive Catalogue of the Grasses of the United States, just received, is a valuable contribution to the literature of our Gramineæ. The genera are described, and under each are arranged all the species which occur within the limits of the United States. A few synonyms are given, enough to enable one to use the catalogue in connection with the older manuals. A summary at the end of the volume gives the whole number of genera in the United States as 120, and of species 675. Following the catalogue proper is a synopsis of the tribes of North American grasses based upon Bentham and Hooker's arrangement in the Genera Plantarum. Two years ago the same author published a somewhat similar catalogue in which there were 114 genera and 589 species. We will repeat what we have said several times already, that work of this kind coming from the Department of Agriculture at Washington tends to raise the value of the department in the eyes of the scientific men of the country.